Postal Regulatory Commission
Submitted 9/19/2014 3:01:05 PM
Filing ID: 90370
Accepted 9/19/2014

Before the
POSTAL REGULATORY COMMISSION
WASHINGTON, DC 20268-0001

Price Elasticities and Internet Diversion) Docket No. RM2014-5

PUBLIC REPRESENTATIVE COMMENTS

(September 19, 2014)

I. INTRODUCTION

On July 9, 2014, pursuant to petition, the Commission issued a Notice and Order establishing this proceeding to consider a request to change an accepted analytical principle regarding the elasticity of demand model of the Postal Service.[1] In response to that Notice and Order, these Public Representative Comments present the attached paper, discussed below, prepared by Professor Mark J. Roberts.[2]

The petition requested a Commission proceeding to consider improvements in the econometric volume demand model prepared by the Postal Service to measure the price elasticities of demand for postal products.[3] The Commission viewed the petition as a request to identify areas of possible improvement in demand analysis and forecasting and to potentially amend the Commission's rules in 39 CFR part 3050. Notice and

[1] Notice and Order Scheduling Technical Conference (Notice and Order), Order No. 2117, July 9, 2014.

[2] "Estimating Price Elasticities of Demand for Postal Products," September 15, 2014.

[3] Petition to Improve Econometric Demand Equations for Market-dominant Products and Related Estimates of Price Elasticities and Internet Diversion, May 2, 2014 (Petition).

Order at 4. As a first step, the Commission intends to explore the current methods of deriving demand elasticities by product and alternative methods already developed. *Id.* at 4-5.

To that end, the Notice and Order attached a recent technical paper discussing a proposed model for estimating United States postal price elasticities.[4] A technical conference was held on August 13, 2014 where Mr. Edward S, Pearsall presented the paper and responded to questions.[5] The Commission requested comments on the paper and matters discussed at the technical conference by September 19, 2014.

II. PROFESSOR MARK J. ROBERTS' ANALYSIS

To assist in providing Public Representative Comments, the Public Representative retained for consultation on the paper and technical conference Mr. Mark J. Roberts, Professor of Economics at The Pennsylvania State University at University Park, Pa. Professor Roberts has extensive experience in estimating empirical models of firm cost, productivity, and demand. His research fields are industrial organization and empirical microeconomics and he teaches graduate courses in both areas. He has published papers in the top journals in the Economics profession including *The American Economic Review*, *Econometrica*, *The Journal of Political Economy*, and *The Rand Journal of Economics* and his research papers have been cited more than 11,000 times in Google Scholar. He is also a research associate of the

[4] "A Branching AIDS Model for Estimating U.S. Postal Price Elasticities," Lyudmila Y. Bzhilyanskaya, Margaret M. Cigno and Edward S. Pearsall, undated. The views are those of the authors and not endorsed by the Commission. Notice and Order at 5.

[5] A list of files for the technical conference, August 13, 2014 was filed on August 14, 2014. Library Reference PRC-LR-RM2014-5/2.

National Bureau of Economic Research, and board member for the Industrial Organization Society, and the Conference for Research on Income and Wealth. Over the period 2001-2006, he worked with economists in the Office of the Consumer Advocate at the Commission to prepare empirical studies of cost variability in mail processing plants and he presented his research in two seminars before the Commission. Professor Roberts testified before the Commission in Docket No. R2006-1 on estimation of cost elasticities.

Professor Roberts' analysis offers several observations on the branching AIDS model paper. He concludes the AIDS model provides an appropriate starting point for analyzing the aggregate quarterly time-series data used in the study but discusses the difficulty of estimating price elasticities, and particularly elasticities that vary over time, with this type of data. He identifies some extensions of the model, including incorporating a richer set of demand controls and disaggregating the data by some geographic area that could help estimation of demand curves for postal product. However, he believes that the type and quality of the data, rather than model specification, represents the biggest weakness in this area of demand analysis. He suggests that micro data on types of mail customers could provide better estimates of demand curves. Measures of relative prices would be useful to capture non-postal products substitutions. These steps would improve the demand and price elasticity estimates.

III. CONCLUSION

The Public Representative hereby submits the paper of Professor Mark J. Roberts, "Estimating Price Elasticities of Demand for Postal Products" (Attachment) as Public Representative Comments on the technical paper and discussion for the Commission's consideration.

Respectfully submitted,

Kenneth E. Richardson
Public Representative

901 New York Ave., NW Suite 200
Washington, D.C. 20268-0001
(202) 789-6859; Fax (202) 789-6891
e-mail: richardsonke@prc.gov

Estimating Price Elasticities of Demand for Postal Products

Mark J. Roberts
Professor of Economics
The Pennsylvania State University

September 19, 2014

I. Introduction

Estimates of the price elasticity of demand for different postal products are important in predicting the effect of price increases on postal revenue. With the decline in the volume of U.S. mail over the last decade there is interest in how this may have affected the price sensitivity of demand for postal products. There is a long history of estimating these elasticities using aggregate, quarterly, time-series data for the U.S. In this paper I review a recent addition to this literature, "A Branching AIDS Model for Estimating U.S. Postal Price Elasticities" by Bzhilyanskaya, Cigno, and Pearsall.

This paper consists of two parts. In the first part, I summarize the Almost Ideal Demand System (AIDS), discuss its usefulness in estimating the demand for postal products, and summarize the application by Bzhilyanskaya, Cigno and Pearsall. In the second part I discuss a number of issues that are relevant to demand estimation for postal products. These issues are general and apply in many cases to the demand models estimated by the USPS as well as the new paper summarized in part one. Some of the issues can be addressed with the existing aggregate data but, given the large number of studies using this data, further modeling refinements seem unlikely to significantly change the existing results or, more importantly, be able to address the question of whether demand elasticities have changed over time. Collection and analysis of micro data on postal customers would provide a substantially different approach to estimation of the demand for postal products

II. A Branching AIDS Model for Estimating U.S. Postal Price Elasticities

The basic goal of an empirical demand model is to measure how the quantity of a product consumed responds to changes in the price of the product, the existence and prices of substitute and complementary products, factors that affect the number of consumers, and their level of income or economic activity. In general, the demand for a product will depend on the prices of all other products that could be substitutes or complements for it. This could be a very large set of prices and lead to a large number of explanatory variables in each demand equation. In addition, if the available time series data is short and many of the prices tend to move together over time, both of which are frequently true with aggregate data, it can be impossible to precisely estimate own and cross-price effects from regressions of the quantity of a product on the prices of all substitute and complementary products. To make progress estimating a demand model, the analyst needs to place some structure on the patterns of substitution or complementarity between products.

In a recent paper, Bzhilyanskaya, Cigno, and Pearsall (2014), hereafter BCP, have estimated a model of demand for different postal products. The goal of their empirical model is to estimate the response of mail volume in a large set of rate categories to changes in the price of any one product in the system, that is the own-price and cross-price elasticities of demand for different classes and categories of mail. The authors use the Almost Ideal Demand System (AIDS) to model the demand for different classes and categories of mail and place some structure on the possible pattern of substitution among products. Before summarizing their paper I will provide a brief overview of the AIDS model.

The AIDS demand model was developed to analyze how consumer's divide their expenditures across different categories of goods and change their division in response to income and price changes. It was also developed to be applied to data on product expenditures that have been aggregated over consumers, rather than individual household or firm data. It has been widely used to study consumer demand, particularly in the area of food purchases, using time-series data for a country or panel data on

multiple cities within a country over time.[6] The model is general enough to allow each product consumers purchase to potentially be a complement or substitute for every other product, and thus a price change for one product can have an impact on the whole bundle of products consumed.

The model is empirically tractable because it breaks down the consumer's purchase decision into stages. For example, in the area of food purchases, consumers can be modeled as, first, deciding how much of their income to spend on food, second, dividing their food budget across different categories such as meat, dairy, vegetables, cereals, beverages, etc. and, third, allocating the budget within each category across different products such as beef, pork, chicken, and seafood in the meat category. Because of this interconnected budgeting process, a price change for one of the most disaggregated products can affect the purchases in all categories. For example, an increase in the price of beef can lead the consumer to reduce the purchase of beef and substitute into other meat products. This price increase also makes the meat category more expensive which can lead the consumer to substitute into vegetables or cereals at the second stage. Finally, the price increase makes food more expensive and the consumer may reduce overall purchases of food at the first stage. In this way, a price increase for beef leads to a reduction in the consumption of beef, which is measured by the own-price elasticity of demand for beef, and an increase in the consumption of substitute products for beef and a reduction in the consumption of complementary products. These latter two effects are measured by the cross-price elasticities of demand.

Corresponding to each level of decision-making in the AIDS model is a set of equations that are estimated. The basic equations express the expenditure share on a product or product group as a function of the prices of the products at the same level as the consumer's decision. Continuing with the food example from above, at the most disaggregated level there would be equations for beef, pork, seafood and other products in the meat category. Each equation would give the expenditure on one

[6] The original paper, "An Almost Ideal Demand System," Angus Deaton and John Muellbauer, *The American Economic Review,* Vol. 70, No. 3 (June 1980), pp. 312-326 has been cited more than 3900 times in Google Scholar.

product as a share of the total expenditure on meat. The explanatory variables would be the prices of all the meat products and the total expenditure on meat deflated by a price index to remove inflation effects. At the next level, there would be expenditure share equations for each of the food categories, meat, dairy, grains etc. where the expenditure is relative to total spending on food. The explanatory variables are aggregate price indexes for meat, dairy, grains, etc. and the deflated total expenditure on food. At the first level, there is an equation explaining the total expenditure on food as a function of a price index for food and consumer income. From this system of share equations, the own and cross-price elasticities can be constructed. These elasticities are not constants, but rather will vary across observations in the data set (i.e. years) as prices and expenditure shares change.

The AIDS model is a reasonable starting point for modeling the demand for postal products using aggregated time-series data on the expenditure, volume, and price for each product. BCP use quarterly time-series data for the whole country from 1971 Q3 to 2013 Q4 and divide the mail flow into six mail classes (First-Class, Priority and Express, Periodicals, Standard Regular, Standard Nonprofit, and Package Services), and 20 mail categories (see BCP Figure 1, p. 4) which generally divide each class into the options for presorting and processing by the mailer.[7]

They divide the decision process into three levels:

- Level 1 (trunk level) expresses the total U.S. expenditure on postal services as a function of an aggregate price of postal services, aggregate income and wealth, and exogenous variables that control for the introduction of new products and the expansion of internet penetration. The latter is viewed as a substitute for mail services. This level is analogous to the consumer expenditure on all food in the example above.
- Level 2 (mail class). This consists of six equations. Each expresses the share of total mail expenditure for a mail class (i.e. expenditure on First-Class mail as a share of total expenditure) as a function of the price index

[7] They also divide each rate category, where relevant, into letters, flats, and parcels but, to keep the discussion clearer, I will ignore the shape-level modeling. I will discuss the division of the mail products by shape in the section on identifying customer groups below.

for all six classes, the aggregate real expenditure on postal services, and the variables that control for the introduction of new products and the expansion of internet penetration.

- Level 3 (rate category). This consists of twenty equations. Each expresses the share of the total class expenditure on one category (i.e. the share of single-piece mail in total First-Class expenditure) as a function of the prices of the other categories in the same class, total real expenditure on the class, and the other exogenous variables that control for demand shifts.

The division into the six classes used by BCP corresponds roughly with distinct groups of mail customers and the rate categories within each class generally reflect the mailing options that customer group faces. For example, the Standard Mail class will be dominated by advertising and bulk mailers who have the option of switching among the non-automated, automated, and ECR rate categories in response to changes in the relative rates of the categories. The First-Class mail class will be a mix of households and small businesses as well as large business mailers such as credit card companies, financial institutions, and utilities. At least some of these mailers have the option of shifting their expenditure among the single-piece, automated presorting, and non-automated presorting rate categories in response to rate changes. Overall, the disaggregation into different levels of products should be based on the different product choices that a mailer has at each level.

Given the breakdown of mail expenditures into the three levels in BCP, it is likely that most substitution will occur across rate categories within the same rate class, that is, at level 3. For example, when the rate for non-automated Standard Mail increases it is most likely that the customers that use Standard Mail most intensively, such as advertising mailers, will substitute into the automated or ECR rate categories within the Standard Mail class. The rate increase for non-automated Standard Mail will then reduce the volume of mail in that category but increase the volume in the automated and ECR categories if they are substitutes. [8] This price increase for Standard Mail can also act at level 2 to affect the allocation of expenditures across the six mail classes and

[8] The price increase would lower the volume of mail in categories that are complements.

the price increase for overall mail services can then act at level 1 to reduce the total demand for mail products.

The AIDS model, as applied in BCP, allows for a general pattern of substitution, including the possibility of no substitution, across rate categories within each class of mail. While the AIDS model does put structure on the possible substitution patterns, it allows a unified treatment of the response of all mail categories to changes in postal rates. This framework is helpful because it does limit the number of prices that appear at each level of the estimating equations but still allows the price of any product to affect the demand for all products. In contrast, the demand models reported in USPS (2014), "Narrative Explanation of Econometric Demand Equations for Market Dominant Products," and USPS (2013), "Analysis of Postal Price Elasticities" treat each product in isolation. The demand for each product is allowed to depend only on its own price and variables that act as demand shifters, such as income or measures of economic activity, but not on the prices of any other postal products. How important the cross-price effects are in practice is an empirical question, but it is very restrictive to assume that they do not exist at the start of the analysis.[9]

The main empirical results are reported by BCP in Tables 2, 3 and the Appendix. Table 2 reports the six demand equations for level 2 (mail class). The price elasticities at the class level are derived from these estimates, together with the demand equation at level 1 (which is not reported), and are reported in Table 3. The own and cross-price elasticities at the category level are reported in the Appendix and are a combination of substitution patterns at all three levels.

The class-level elasticity estimates reported in Table 3 are derived using the sample averages of the underlying variables in 2013. The estimates are all negative, as required of a demand elasticity, and the absolute value is less than one for four of the categories, implying inelastic demand for the four classes. There are a number of

[9] The USPS studies reference attempts in prior years to include prices of other products in some of the demand equations but these prices have been eliminated in the most recent estimates. Simply adding additional product prices to the USPS estimating equations for a given product is unlikely to be a useful approach because of the high correlation in the prices of different products over time. This issue is discussed in more detail in the next section. The structure placed on the estimating equations by the AIDS model is useful in specifying how other product prices should be incorporated in the analysis.

statistically significant cross-price elasticities although more explanation is needed to assess the reasons for the patterns and reasonableness of the magnitudes. At the category level, reported in the Appendix, the own-price elasticities tend to be more elastic than at the class level and the cross-price elasticities within the same class are often significant. These are the kind of patterns we would expect and they indicate substitution among the rate categories within a given class. However, if all product prices increase together the elasticity of demand for each class of mail is inelastic falling between -.61 and -.86. This is very similar to the estimate of the price elasticity at the trunk level, -.71.

III. Topics for Further Study

This section discusses a number of issues that need to be explored further if the goal is to develop accurate estimates of own and cross-price elasticities for postal products. Where possible, I offer some suggestions for alternative approaches. These issues apply to the models estimated in BCP as well as USPS (2013, 2014).

Identifying the Customer Groups

Estimation of a demand model should begin by identifying the relevant group of consumers and then the set of mail products they are likely to purchase. The demand curves should represent specific types of customers. While the customers of the USPS are very diverse, there are a small number of customer groups that account for a very large percentage of total purchases of mail services. At the risk of oversimplifying, there are six customer groups that are important to distinguish because they differ in the categories of mail services they are likely to utilize and the relevant alternative non-postal products that are substitutes they could choose. This will lead to a different demand curve for postal services for each group.

· Households and small business that primarily use the mail for personal communication and bill paying. They are small scale users and primarily use single piece, First-Class mail. They may also use Priority and Priority Mail Express, and

Media Mail. Non-postal alternatives include internet usage for online payments and email.

· Businesses that use the mail to send bills or statements to large numbers of customers. These include credit card companies, financial institutions, utilities, Netflix. These businesses use First-Class mail with the option of single piece, nonautomated, and automated categories. They also use internet as an alternative.

· Advertisers. This group of customers uses Standard Mail with the option of non-automated, automated, and ECR categories. Internet advertising, radio, and television are all alternative advertising mediums.

· Nonprofit organizations. This group of uses Standard Nonprofit Mail class with options for non-automated, automated, and ECR categories. They may also use Library Mail, Media Mail, and BPM.

· Magazine and newspaper publishers. Their purchases will generally be in the Periodical class. Internet distribution is a non-postal alternative.

· Businesses that sell or deliver products through the mail. They will primarily use the competitive products such as Standard Post or Parcel Select (primarily the former Parcel Post) and Priority and Priority Mail Express categories. For this group, Fed Ex and UPS are important alternatives.

These six customer groups roughly break down along the lines of the six major classes of mail used in the demand studies by BCP and the USPS. To estimate a demand curve for each class we need to identify the set of products that the mail customer is choosing among and the important non-postal alternatives. Some of the mail classes, for example advertisers, may fit closely with the relevant customer group and the existing data could be used to estimate a demand curve for that group. However, not all of the mail classes fit nicely into distinct customer groups and this will limit the usefulness of the existing data. One mail class that does not appear to fit this breakdown accurately is the Periodicals class. While the periodical mailers may be a well-defined group of users, the rate categories below them (in-county, non-profit, classroom, and regular rate) reflect characteristics of the groups receiving the mail, rather than options that the periodical mailers can substitute among. The rate categories within the Periodicals class do not seem to correspond to alternative mail

products that the mailer can move among in response to changing prices. Another example of where the classification into mail classes and categories does not fit well with the concept of demand curves for customer groups is the Priority and Priority Mail Express products. These products are substitutes for First Class mail or Standard Post for households and Standard Post and Parcel Select for businesses that sell through the mail and changes in the price of these products could affect demand for other classes of mail. A third example is the market dominant Package Services class. This class and the rate categories it includes, Bound Printed Matter, Media and Library Rate, do not seem to represent any clearly defined group of customers. In these cases where mail classes do not match well with customer groups, interpreting results of mail class estimates as demand curves is problematic. If the existing data is collected at more disaggregated levels and then aggregated to the classes and rate categories that are reported, it may be possible to aggregate the underlying data in a different way that would more closely correspond to customer groups.

One additional issue is how to treat the mail flow by shape. In their paper, BCP treat disaggregation into flats, letters, and parcels as the finest level of disaggregation and estimate the demand curves at the shape level. Given the focus of this section on customer groups, it is not clear that letters, flats, and parcels should be treated as separate products. If a customer group, such as households, is using a mix of the three shapes then it would be appropriate to treat them as purchasing a bundle of postal services and estimate a demand curve aggregating over the shapes.

Overall, a demand curve should represent the mail services used by a specific group of customers. The customers in the group can move between different mail products in response to changing prices or other demand conditions. The demand curve should include the prices of all the substitute mail products used by the customer group. Other demand shift variables, such as the level of economic activity and the prices of non-postal substitute products, can be tailored specifically to the customer group.[10] Ideally, it would be desirable to estimate separate demand curves for each of the six customer groups identified above. Given the way the USPS data is aggregated

[10] For example, in USPS (2014), mail-order retail sales are used as a demand shift for First Class parcels volume while exports are used as a demand shifter for First Class International mail.

and reported, this does not appear to be possible for all these groups, but does seem feasible for some of the groups such as advertising and bulk mailers.

Estimation Using Aggregate, Quarterly Time-series Data

The data that has been used to estimate demand curves by mail class or rate category is total revenue, total volume, and an average price for the whole country for calendar quarters. This data is available quarterly from the early 1970's through the present and studies differ in what segment of the time interval they use. The data only summarizes quarterly time series variation in total mail activity by class and rate category and, in the last decade, by shape. Mail volume grew through the mid 1990's but has trended down in many mail categories since the late 1990's. Postal rates have trended upward over the whole period but generally in discrete steps following postal rate cases. Many of the important variables that shift demand such as income, level of business activity, and internet usage also trend upward over time. The introduction of new products, such as work-sharing rate classes, are introduced at distinct points and then adoption occurs gradually over time.

The estimates of demand models using this data has generally found that variables measuring economic activity by households or businesses and the introduction of new products are important demand shifters. The effect of price changes for postal products has had only modest effects on the volume of mail. In general, the demand curves for different classes and rate categories are inelastic with price elasticities of demand virtually always less than one (see Figure 1, page 14 in Bozzo, Capogrossi, Eakin, and Srinivasan, contained in USPS (2013) for summary).

In assessing the demand models it is important to understand the source and magnitude of the price variations in the data. In BCP and USPS (2013, 2014) there is very little discussion of the price data and no systematic summary measures are provided so, without studying the source data, it is impossible to know the magnitude of price variation. In order to estimate own and cross-price elasticities it is necessary to have variation in the relative price of different mail products over time. Since the postal

rates are generally fixed over time intervals between rate cases, there should be no price variation for many time periods. In addition, if prices for different products tend to change by the same percentage when they are adjusted then relative prices of the products do not change and there is no data variation to use in estimating demand models. In the AIDS model estimated by BCP, this would lead to price variation only at Level 1 where the aggregate price of postal services would vary relative to an aggregate price index for all other goods. It would not be possible to estimate price responses at the other levels. While the case of no relative price variation is extreme, if there is little price variation in the data then estimates of own and cross price elasticities will be very imprecise and this could explain the large number of insignificant price coefficients in the empirical results.

Related to this last point, it is important to use the time variation in prices that occurs following the major rate cases to estimate the demand models. These are the periods in which price changes can be affecting demand. Treating these time periods as unusual and including "intervention variables" to control for them, as is done in some of the USPS estimates, effectively removes the price variation as an explanatory factor. For example, in the estimates for Standard Nonprofit Mail in USPS (2014, p. 45) the classification reforms in late 1996 led to a change in the relative price of ECR and automation mail and migration of mail among the Nonprofit rate categories. This was controlled for with some time trend variables that will reduce the role of the price variation in explaining the volume changes.[11]

Overall, it is difficult to use aggregate time series data to precisely estimate the separate role of variables that are all trending over time. One possibility, which may be feasible with the existing data collected by the USPS, is to disaggregate the data by a geographic dimension such as Postal Districts or Areas and estimate the demand models using panel data on the geographic areas and years. Since postal prices are the same across all regions this will not improve the amount of price variability in the

[11] If the goal is to simply use the model to forecast future mail volume by category, this might be more accurate, but it does not use the price information to help estimate price elasticities.

data, but it could help identify the effect of other variables that differ by region such as the level of economic activity and the number of household and business customers. In addition, if the variables with geographic variation were interacted with the price variables it might be possible to estimate differences in demand elasticities across areas.

Variation in Price Elasticities over Time

One reason for studying price response for postal products is the belief that the growth of alternatives to mail services have led to changes, particularly increases, in the price elasticity for these products. This can occur because the discovery and growth of competing products, such as electronic mail, gives customers more alternatives to postal services and makes them more price sensitive. However, if customers are heterogeneous in their price sensitivity, the introduction of new competing products can lower the total demand for mail products as some customers leave, but might actually lead to more inelastic demand as the remaining customers are the ones with few alternatives.

Of particular interest is the role of internet growth on the elasticity of demand for mail products. BCP include a variable for internet penetration among the demand shifters in their model and they interact this variable with the prices of the mail products. This does allow the demand elasticities to change as internet penetration increases, without imposing whether the elasticity increases or decreases, but they do not find any significant effect of internet penetration in the aggregate data. This result is probably heavily affected by the use of aggregate U.S. data, the relatively short time period that the internet has been a viable alternative, and the fact that U.S. penetration rates do not capture the intensity of internet usage. As suggested in the previous section, the use of regional data and the measurement of internet usage at more disaggregated geographic levels may provide more variation in internet adoption but, overall, I think it

will be very difficult to precisely estimate interaction terms between postal prices and internet use with aggregate time series data.[12]

An alternative to including variables to measure internet usage, is to estimate the model using different subsets of the time-series data. For example in Bozzo et.al (2013), they divide the data into rolling time periods of 40 or 60 quarters and estimate the elasticities for different subperiods of the data. The tradeoff is that each subperiod contains fewer data observations. Given the aggregate U.S. data available, estimating on subperiods or looking for time periods with structural breaks is probably the only option available.

Modeling Issues – Persistence and Endogeneity

In the aggregate data there is likely to be some persistence in mail volumes over time that will not be fully explained by observable variables. The empirical models have dealt with this in various ways. BCP allow for four quarters of serial correlation in the error term of the demand equations. This allows for the possibility that unmeasured shocks that raise or lower the demand in a particular period may persist over time. In most of their regressions, they find that a one-quarter lag is sufficient to capture the persistence in the errors and that two-quarter lags are always sufficient to control for the serial correlation.

In USPS (2014) the models include the prices in previous quarters as additional control variables. Up to four lagged prices are included, although the exact number varies by product. The assumption behind this is that it may take mail customers one to four quarters to adjust to the new prices so that the mail volume only responds slowly to changes in mail rates. The difficulty with this approach is that, if prices are fixed over quarters between rate cases, then there is very little difference in the current and lagged prices. This will make it extremely difficult to precisely separate the effects of current and lagged prices. This problem is somewhat ameliorated by constructing the long-run

[12] The AIDS model has elasticities that change at each data point as the prices and expenditure shares vary over time. BCP report results for 2013 and it would be possible using their model to see if the elasticities have changed systematically over time.

price elasticities which sum the coefficients over the current and lagged prices.[13] Bozzo et. al. (2013) impose a polynomial lag structure on the coefficients of the lagged prices in order to reduce the large variation in coefficient estimates that results from the use of many highly-correlated prices as the regressors. Given the nature of the data, it appears that trying to estimate patterns of slow adjustment by mailers is not going to be very successful and that correction for serial correlation as done in BCP is sufficient.

Another issue that arises when estimating demand models concerns the endogeneity of prices. This problem arises in market level data because unobserved shocks to the demand curve will also tend to result in price changes. In this case, ordinary least squares regressions of quantity on price will not measure the true price elasticity. As an example, suppose there was an unforeseen shock to the demand curve that increased the demand for the product. This demand will appear in the data as an increase in quantity purchased, but it will also tend to result in an increase in the market price. In the data, the movement between quantity and price, which is used to estimate the demand elasticity, does not reflect the impact of a pure price change on the quantity but rather the combined effect of the demand shock and the price change on quantity. The difficulty this creates for estimation of price elasticities is that it biases them toward zero, that is, it makes demand curves look more inelastic than they truly are.

In the estimation of postal demand curves this may or may not be a serious problem depending on the price data used. The USPS studies tend to use a fixed-weight price index, which is a weighted average over the postal rates for a group of mail products. If the prices and weights are fixed over time and only change because of decisions in rate cases they can be argued to be exogenous in the time-series data. However, if the weights change quarterly or annually because of changes in the mix of mail products captured by the price index, then the endogeneity bias is a source of concern. In their paper, BCP do not use the fixed weight price directly. They use the

[13] Some variation over time may be introduced in their data by deflating the prices by the Consumer Price Index. This would seem to be a fairly weak source of price variation to use to estimate the effect of lagged prices on current mail volumes.

average revenue per piece of domestic mail as the price of each product in the demand curve. This will be endogenous because the revenue will capture the random shocks to the demand curve. Time periods with shocks that increase demand will also tend to increase revenue and the measured price. The authors recognize this issue and control for it using the fixed-weight price index as an instrumental variable. This is an appropriate econometric method for dealing with endogeneity problems but its successful application depends crucially on the instrumental variable being uncorrelated with the shock in the demand curve. For the reasons discussed in the last paragraph, depending on how it is constructed the fixed-price index may be correlated with the demand shock and thus not satisfy this criteria.

Overall, given the focus on estimating price elasticities and the common finding that the elasticities are generally less than one in absolute value, a more thorough analysis of the likely impact of endogenous prices is needed. Providing evidence that endogeneity is not an empirical problem or that it can be successfully corrected with appropriate econometric techniques is more important than issues of model specification that have been the focus of much of the effort in this area.

Using Micro Data on Postal Customers

One paper that takes a very different approach to the estimation of demand elasticities is Hong and Wolak (2008). They model the demand for postal services for one customer group, households. They rely on household-level data from the Consumer Expenditure Survey to measure household expenditures on postal products from 1986 to 2004. They use an alternative data set to model the probability a household owns a computer and incorporate it into their model of postal demand. In addition, they use the relative price of postal services to telephone services to capture the fact that postal prices had risen relative to alternative forms of communication. Their data show that periods of postage price increases were accompanied by declines in household postage expenditure. They find that household postal demand is elastic, with an estimated demand elasticity of -1.65, much larger than estimates from the

aggregate data. They also find a significant positive cross-price elasticity with telephone prices, implying that a reduction in telephone prices lowers the demand for postal services, and that household computer usage significantly reduces the demand as well.

The Hong and Wolak paper illustrates many of the advantages of using micro data on customer groups to estimate demand. The control variables are specific to the customer group and capture the relevant substitution possibilities for the users and there is large variation in these variables across individual customers. The variables can also be interacted with the price variables to try to measure variation in price elasticities across households with different characteristics, such as the age of the household head. Hong and Wolak had to construct their data from sources that were not specifically designed to collect information on postal usage and thus had to deal with a number of data limitations, but their analysis nicely illustrates the potential for using micro data to estimate demand curves and price elasticities.

IV. Summary and Conclusions

There is a long history of studies by the USPS and others that have used aggregate time-series data on volume, revenue, and prices to estimate demand models for individual mail classes and rate categories. The models differ in terms of specification, particularly how they treat the prices of substitute products, and econometric methods, particularly how they deal with the persistence that arises in time-series data. Overall, the results consistently indicate that own-price elasticities are less than one in absolute value, implying that demand for the mail products at many levels is inelastic.

The AIDS demand model estimated by Bzhilyanskaya, Cigno, and Pearsall provides a way of estimating own-price and cross-price elasticities in a framework that is consistent with economic theory and that is designed to be applied to aggregate product data. The model produces elasticity estimates that are slightly larger in absolute value than other studies. At the level of the rate category, there are several cases where cross-price elasticities are large, implying substantial substitution across rate categories, but, when aggregated to the level of mail classes, the basic conclusion that

demand for postal products is price inelastic is not affected. The AIDS model provides an appropriate starting point for analyzing this type of data and the model can be extended in several ways. It can incorporate a richer set of demand controls, in particular, different controls for different mail classes or rate categories. It could also be estimated using panel data disaggregated by some geographic dimension such as Postal District or Area if this data is available.

The biggest weakness in the area of demand estimation for postal products is not model specification, but the type and quality of the data. Mail volumes have clearly been impacted by the development of electronic alternatives and, recently, the decline in economic activity. Measuring the impact of price changes on mail volume, however, requires that there be variation in prices and, in particular, relative prices of mail products over time. While postal prices have changed over time, trending upward, so have some of the other aggregate variables, particularly ones capturing the size of the economy making it difficult to estimate effects from aggregate data.

Micro data on mail customers could help provide better estimates of demand curves for postal services. Households, business users, advertising mailers, and businesses using the mail for parcel delivery could be distinguished and demand curves for each customer group could be estimated. The demand curves for each group of customers could include different measures of economic activity. There would also be substantial variation in these measures, such as differences in household income or firm size, across customers in the same group. Also, measures of relative prices could be constructed that capture the important non-postal products that customers in the group would substitute into. This could be telephone prices for households and businesses or FedEx and UPS prices for parcel mailers. While this approach requires new data collection, I think it provides the path that is most likely to result in improved demand and price elasticity estimates for postal services.

References

Bozzo, A. Thomas, Kristen L. Capogrossi, B. Kelly Eakin, and Mithuna Srinivasan (2013), “Is Demand for Market Dominant Products of the U.S. Postal Service Becoming More Own Price Elastic?” in “Analysis of Postal Price Elasticities,” USPS.

Bzhilyanskaya, Lyudmila Y., Margaret M. Cigno, and Edward S. Pearsall (2014), "A Branching AIDS Model for Estimating U.S. Postal Elasticities."

Hong, Seung-Hyun and Frank A. Wolak (2008), "Relative Prices and Electronic Substitution: Changes in Household-Level Demand for Postal Delivery Services from 1986 to 2004," Journal of Econometrics, Vol 145, PP. 226-242.

U.S. Postal Service (2014), "Narrative Explanation of Econometric Demand Equations for Market Dominant Products," filed with Postal Regulatory Commission, January 22, 2014.

U.S. Postal Service (2013), "Analysis of Postal Price Elasticities," White Paper, May 1, 2013.